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by Edi Erwan

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Effect of the Levels of the Virgin Coconut Oil Processing Waste (*Blondo*) on Productive Performance and Egg Quality of Laying Hens

Husmaini[1], M.H. Abbas[1], E. Purwati[1] and Edi Erwan[2]
[1]Faculty of Animal Science, Andalas University, Limau Manis Campus, Padang, Indonesia
[2]Department of Animal Science, Faculty of Agriculture and Animal Science,
State Islamic University of Suska, Pekanbaru, Indonesia

Abstract: *Blondo*, a by-product of virgin coconut oil processing, contains a large quantity protein and lactic acid bacteria. The objective of this study was to compare the substituting of Commercial Diet (CD) by *Blondo* on the performance productions, egg weight as well as yolk cholesterol in laying hens. Completely randomized design was used to analyze the data, one hundred and sixty Isa Brown (19 weeks old) laying hens were observed in this study. Groups were randomly assigned to 4 treatments with 5 replications. Treatment diets were prepared by substituting 0, 7, 14 and 21% with *Blondo* to commercial layer feed. The results showed that the use of *Blondo* in CD significantly (P<0.01) improved feed intake, protein intake and yolk cholesterol as well as to hen day, egg mass, feed conversion ratio and egg weight. The diet containing 7% *Blondo* resulted the best performance in which hen day production 88.92±1.15%, egg mass production 44.47±1.73 g/d, egg weight, 49.71±0.95 g, feed conversion ratio 2.20±0.07 and provided income over feed cost IDR 12, 822±290/head/period, respectively. The higher the *blondo* use in CD, the lower the yolk cholesterol. The use *blondo* up to 21% in a commercial diet decreased yolk cholesterol content until 34.50±7.33 mg/dl. We concluded that *Blondo* could be used as an alternative ingredient for commercial diet of laying hens.

Key words: *Blondo* level, laying hen, performance production, income over feed cost, cholesterol

INTRODUCTION

Poultry production cost has increased substantially in recent years due to the increase in price of feed ingredient cost represent 60-80% particularly soya bean and corn (Raghavan, 2009). Poultry diets price fluctuations is depend on feedstuff which used in formulating of diets. The use of feedstuff such as soybean meal and fish meal that imports was caused the price of the diet to be expensive. Corn is the largest proportion in the composition of poultry diets. Procured competes with human consumption and as a source of fuel, so the price of corn increased and then accumulates causing diet becomes more expensive and fluctuating.

Hence, the search for cheap, locally available and equally nutritive feed source to partially substitute commercial poultry diet has never been more pressing (Preston, 1995; Wong and Tan, 2009).

Additionally, one of the way to solve the problems above especially to reduce the cost of feed is seeking the alternative feedstuffs that which not compete with human needs but has a high nutritional value. Its use in the diet can reduce production costs but does not interfere the performance and quality of livestock products, that the income over feed cost is increase. Utilization of agro-processing industrial waste can be used as a source of alternative feedstuff for poultry such as *Blondo*. *Blondo* is an industrial waste manufacturing Virgin Coconut Oil (VCO). VCO is an oil that is processed without high heating, the moisture and free fatty acid are low, translucent color and fragrant with the shelf life more than 12 months (Rindengan and Novarianto, 2005).

Purwati *et al*. (2006) reported that the chemical analysis of *blondo* without being processed (wet *blondo*) is oleic fatty acids (omega-9) 14.321%, linoleic acid (omega-6) 0.166% and linolenic fatty acids (omega-3) 0.052%. The proximate analysis of dried *blondo* (by the sun) contains 81.19% DM, ash 3.58%, 20.63% protein, 0.17% crude fiber, crude fat 19.44%, 18.81% moisture content, ME 4323.34 kcal/kg. *Blondo* also contains *Lactobacillus* that having ab to reduce pathogenic bacteria *E. coli*. Husmaini *et al*. (2007) reported that the Lactic Acid Bacteria (LAB) count on *Blondo* that dried method by the sun more than blondo that dried with low heating method, i.e., 1.03 x 10^8 cfu/g by drying method and 0.93 x 10^8 cfu/g at dried *Blondo* with low heating method. According to Husmaini *et al*. (20011a) LAB from *Blondo* can be used as probiotics in poultry. Fuller (2002) explains that probiotics in poultry causes intestinal microflora balance thus the digestion and absorption of food are better. Previous studies have demonstrated that linoleic acid has anticarcinogenic, antiartherogenic effect and modulates immune responses (Lee *et al*., 1995; Ip *et al*., 1995; Belury *et al*., 1996). Early study has shown

Corresponding Author: Husmaini, Faculty of Animal Science, Andalas University, Limau Manis Campus, Padang, Indonesia

the beneficial effects of linoleic acid supplementation of poultry diets based on "viscous" cereals, such as wheat, barley and rye, are well established (Lazaro *et al*., 2003). However, the data available on the influence of fatty acids, linoleic acid and oleic fatty acids which present in the *blondo* on performance and egg production of laying hen is still limited. Hence, the purpose of this study was to determine the effect of different level substitutions of *blondo* in a commercial diet on performance, egg weight and total cholesterol of laying hens.

MATERIALS AND METHODS

Animal, diet and management: This study used 160 Isa Brown laying hens (19 weeks old). The data was analyzed by using the Completely Randomized Design. Hens were divided into 4 treatments with 5 replications, then placed randomly in individual battery cages (40 x 30 x 30cm). Treatment in this research was percentage of replacing commercial diet by *Blondo,* namely: P0: 0% *Blondo*+100% Commercial diets, P1: 7% *Blondo*+93% Commercial diets, P2: 14% *Blondo*+86% Commercial diets and P3: 21% *Blondo*+79% Commercial diets.

Blondo which is used in this study were obtained from the processing of virgin coconut oil by fermentation methods. *Blondo* was dried by sunlight. The Commercial diet produced by the Gunung Nago Group. The content of nutrients and energy metabolism of diet materials are presented in Table 1, the composition, nutrients and energy metabolism of ration treatment are presented in Table 2.

The treatment diets were given when the hen was 19 weeks old. The pattern of commercial diets replacement with treatment diets was done gradually such as: on the first two day, replacement of commercial diets with 20% of the ration treatments and the next two days replacement with 40%, continuously up to replacement 100% ration treatment. The fed and drink are *ad-libitum*. Lighting program performed by using sunlight at noon and the addition of light at night for 4 hours.

Observation and statistical analysis: Observation of the performance has begun after the hens produce as much as 50% Hen Day (HD). Observations carried out over the next six weeks. The number of eggs produced and egg weight recorded daily, while the consumption recorded per week individually. Protein intake, daily egg production, egg mass production and ration conversion were calculated each two weeks for one observation period. For the examination of the egg cholesterol content, at the end of each observation period, two eggs were taken randomly per experiment unit to test cholesterol from egg yolks. Yolk cholesterol was extracted by Folch *et al*. (1956) method had modified by Washburn and Nix (1974).

Table 1: Proximate analysis of commercial diet and *Blondo* (%)

	Commercial diet	*Blondo*
Crude protein	16.22	20.63
Crude fat	4.28	19.44
Crude fiber	5.47	0.17
Calcium	4.73	0.224
Available phosphor	0.24	0.080
ME (kcal/kg)[2]	2,767.51	4,323.34

Source: Husmaini *et al*. (2007)

Table 2: Composition and calculated analysis of experimental diet[1]

	Experimental diets			
	PO	P1	P2	P3
Composition (%)				
Commercial diet	100.00	93.00	86.00	79.00
Blondo	0.00	7.00	14.00	21.00
Based on the calculation				
Crude protein	16.22	16.53	16.84	17.15
Fat	4.28	5.34	6.40	7.46
Crude fibre	5.47	5.10	4.73	4.36
Calcium	4.77	4.44	4.11	3.78
Phosphor	0.24	0.23	0.22	0.21
ME (kcal/kg)[2]	2,753.58	2,863.44	2,973.30	3,083.16

1: Calculation based on Table 1
2: Calculation based on NRC (1994)

The data obtained were analyzed statistically by using analysis of variance (ANOVA) through completely randomized design of the program SPSS version 15.0 (Command Syntax) and the difference between treatments were analysis by Duncan's Multiple Range Test (DMRT) at a rate of 95% (P<0.05).

RESULTS AND DISCUSSION

Production performance of laying hens during the study in each treatment are presented in Table 3. The results of the analysis indicate that the use of various blondo in commercial rations significantly (P<0.01) affect the feed intake and protein intake and significantly (P<0.05) affect egg production, egg mass and feed conversion ratio.

No significant effect (P>0.05), was found in feed intake and protein intake by substituted *Blondo* in diet up to 14% compared to the control. However, food intake and protein intake was reduced when the inclusion of *Blondo* in the diet higher than 21%. The decreasing of feed intake by providing more *Blondo* might be caused by high crude fat of *Blondo*, hence the energy metabolism of the ration of treatments P3 to be the highest among the other treatments (3, 083.16 vs. 2, 753.58 kcal/kg, Table 2). According to Leeson and Summers (2001) ration consumption is influenced by the energy content of the ration. The higher the ration metabolic energy causes a decrease of the consumption ration.

Table 3 shows that the replacement of 7% of *Blondo* in the ration resulted the improvement of egg production compared to the control. Several possibilities exist to explain this finding. First, *Blondo* contains a Lactic Acid

Table 3: Effect of *Blondo* against laying eggs production performance

Variable	P0	P1	P2	P3	Sig.
FI (g/h)	94.70±5.58^{ab}	97.87±1.37^{a}	89.12±4.21 ^{b}	82.67±2.63^{c}	0.001
PI (g/h)	15.36±0.90^{ab}	16.18±0.23^{a}	15.01±0.71^{bc}	14.18±0.45^{c}	0.006
HDP (%)	79.24±11.52^{ab}	88.92±1.15^{a}	79.64±8.03^{ab}	73.60±2.90^{b}	0.047
WE (g)	48.11±0.87^{b}	49.71±0.95^{a}	50.00±0.48^{a}	49.50±0.91^{a}	0.032
EM (g/d)	38.04±5.17^{b}	44.47±1.73^{a}	39.59±4.23^{ab}	36.41±1.74^{b}	0.039
FCR	2.51±0.19^{a}	2.20±0.07^{b}	2.26±0.16^{b}	2.27±0.06^{b}	0.029
IOFC (IDR/h/period)	8.476.±313	12.822±295	12.458±238	12.643±730	

^{a,b}Means within a row with different superscripts differ (P<0.05).
Treatments:
PO: 0% *Blondo*+100% commercial diet (control)
P1: 7% *Blondo*+93% commercial diet
P2: 14% *Blondo*+86% commercial diet
P3: 21% *Blondo*+79% commercial diet
FI: Feed Intake, PI: Protein intake, HDP: Henday production, WE: Weight egg, EM: Egg mass production, FCR: Feed conversion ratio, IOFC: Income over feed cost, Sig.: Significant

Table 4: Egg weight and yolk cholesterol

Variable	P0	P1	P2	P3	Sig.
Egg weight (g)	48.11±0.87^{b}	49.71±0.95^{a}	50.00±0.48^{a}	49.50±0.91^{a}	0.032
Yolk cholesterol (mg/dl)	96.00±3.68^{a}	80.50±3.11^{b}	43.25±3.22^{c}	34.50±2.33^{c}	0.000

^{a,b}Means with different superscripts within the same row are significantly different (P<0.05).
Treatment:
PO: 0% *Blondo*+100% commercial diet (control).
P1: 7% *Blondo*+93% commercial diet.
P2: 14% *Blondo*+86% commercial diet.
P3: 21% Blondo+79% commercial diet.
Sig.: Significant.

Bacteria (LAB) which potential as a probiotic (Husmaini *et al*., 2011a; Husmaini, 2012). Second, *Blondo* contains unsaturated fatty acids such as oleic, linoleic and linolenic (Purwati *et al*., 2006).

The inclusion of *Blondo* 7% in the ration increased egg production as much as 12.22% and the giving of *Blondo* 14% is produced egg production were similar but the use of *Blondo* up to 21% cause egg production is lower as much as 7.12% than the control. The use of blondo in the diet has increased egg weight (P<0.05) significantly, so that the giving of blondo 7% caused egg mass production also increased significantly as much as 16.90% than control but the use of 21% *Blondo* in diet lead to lower egg mass. The increases of the egg mass due to use *Blondo* in diet in this study led to feed conversion ratio decreased or corrected significantly (P<0.05). The use of *Blondo* upto 7% in ration caused feed conversion ratio to be corrected as much as 12.35%. The use of *Blondo* in the ration has led to increased egg weight (P<0.05), so the mass of eggs also increased significantly as much as 16.90% of the control eggs. But the provision of 21% in ration *Blondo* lead to lower egg mass. The Increase of the mass of eggs that this caused by giving blondo on the ration in this study led to conversion ratio decreased or corrected significantly (P<0.05). The giving of *Blondo* 7% caused conversion ratio is decreased as much as 12.35%. The increases of the production performance in the present study was closely related to probiotics contain in *Blondo* that have affected the intestinal microflora, in which the number of LAB increased whereas the number of pathogenic bacteria *E. coli* and *Salmonella* sp. decrease (Husmaini *et al*., 2010, 2011a). Previous studies revealed that the presence of probiotics in the gut causing intestinal microflora changes that benefit to its host (Fuller, 2002; Ohimain and Ofongo, 2012). Furthermore, it was suggested that the existence of LAB in *Blondo* that serves as probiotics, have led to the condition of the digestive tract to be better in digestion and absorption, so that the ration becomes more efficient to produce eggs (Sellars, 1991; Zulkifli *et al*., 2000; Husmaini, 2011b, 2012).

As shown in Table 4, the substitution *Blondo* on commercial diet increased egg weight significantly (P<0.05) and significantly (P<0.01) decreased cholesterol content of eggs.

The use of *Blondo* 7% in the commercial diet had increased egg weight 3.33% but the difference of level *blondo* had no affect. Increasing in the weight of e caused by LAB in *Blondo* that serves as probiotics, the content of unsaturated fatty acids and prote ontent in *blondo* higher than commercial diet (Purwati *et al*., 2006; Bahlevi *et al*., 2009; Husmaini *et al*., 2011a). The use of *blondo* 7% in the diet reduced total cholesterol eggs significantly as 3.14% (96.00±3.68 vs. 80.50±3.11). The increasing of egg size early in the egg production increased benefits because consumers show preferences for large eggs (Summers and Leeson, 1983; Grobas *et al*., 1999).

The higher substitution of *Blondo* in the ration the lower egg cholesterol content. In this study, the use of 21% *blondo* reduced egg cholesterol as much as 64.06 to 34.50±7.33%. The reducing cholesterol reduction closely related to the ability of LAB in *Blondo*. Many researchers have been made to elucidate how the mechanism involved in the hypocholesterolemic action of lactic acid bacterial strains. It has been reported that the mechanism of hypocholesterolemic caused the assimilation of cholesterol by the cell wall during growth (Buck and Gilliland, 1994; Noh *et al*., 1997). The other mechanism might be the deconjugation of bile salts by bacteria producing bile salt hydrolase (Usman and Hosono, 1999; Al-Saleh *et al*., 2006). Most conjugated bile salt are circulated through the enterohepatic circulation, while deconjugated bile salts are less soluble and extracted in the feces. The bile salts that are excreted must be replaced by new bile salts which are formed by cholesterol in blood. Thus the higher bile salts excreted the higher cholesterol removed from the blood and body. In this research, the higher *blondo* in diet, the higher LAB in intestinal tract of hens that produce more bile salt hydrolase. Similar results were also reported by other authors (Liong and Shah, 2005; Mahdavi *et al*., 2005; Xu *et al*., 2006; Husmaini, 2012).

Blondo substitution in the diets aims to reduce the diets cost but no negative effect on production performance. In this study the use of *Blondo* as alternative feed ingredient in poultry has successfully increased income over feed cost compared to the control. Income over feed cost was highest at the use of 7% *Blondo* as much as IDR.12, 822±295, -per hen. *Blondo* is a waste of VCO processing had both metabolic energy and protein content were higher than commercial diets, besides that, *Blondo* had contain LAB. As the price of *Blondo* was cheaper than a commercial diet in the same unit, so that the diet cost becomes cheaper as substituted by *Blondo*. Though the substituting of *Blondo* 7% in the commercial rations decrease feed intake in term of performance but this ration increased egg production, egg mass and the egg weight as well as improved feed conversion ratio compared to the control. Consequently, as the size of egg becomes larger followed by the increases of income meanwhile decreases of feed intake and as well as the reducing of diet cost, hence final income over feed cost a lot more. Our findings indicated that the use of 7% *Blondo* in diet was the optimum level for the best production performance and income over feed cost.

Conclusion: It is concluded that blondo can become a source of alternative feedstuff for poultry. The use of *Blondo* (VCO processing waste) in the commercial diet have not effect on the production performance of laying hens. Giving 7% *Blondo* into diets was the best, with hen day production: 88.92%, egg mass production 44.47 g/d, correcting the feed conversion ration to 2.20 and provide income over feed cost IDR. 12,822 per hen. Eggs with lower cholesterol content can be obtained by providing *Blondo* up to 21%.

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